



Surface Ship Maintenance Resources

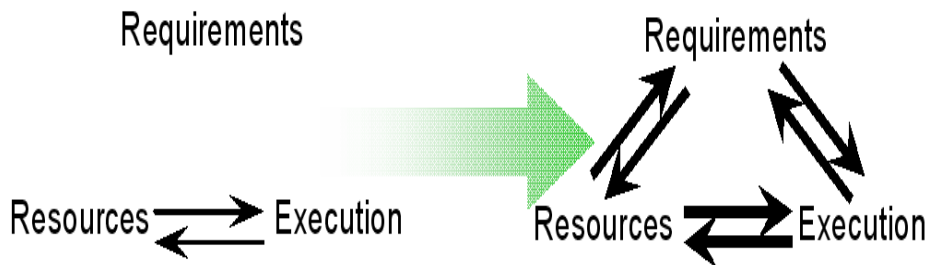
**Kenneth S. Jacobs
SEA 04RM**

VISION: ICMP, MRS & PMS Integration

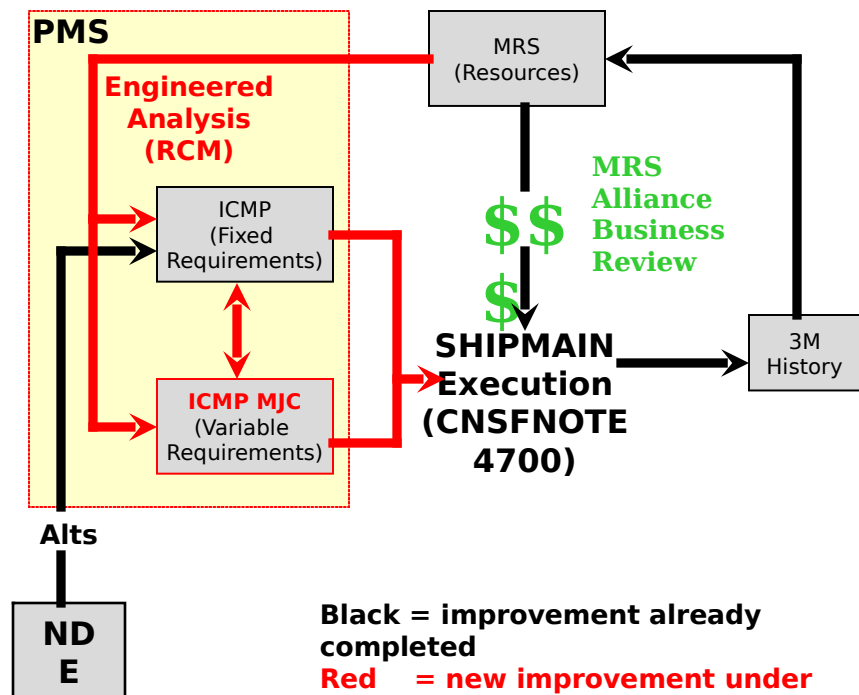


- Correct technical requirements supporting efficient execution
- Rapid transition to work execution to support surge & sustain

Goal is Linkage of:
Technical Requirements,
Resources, and Execution



What we're Doing



Navy Surface Ship Maintenance Transition



FROM

- Time-directed preventive maintenance without considering equipment condition
- Class Maintenance Plan (CMP)- driven repair tasks
- Large, infrequent availabilities
- Static Deployment cycles

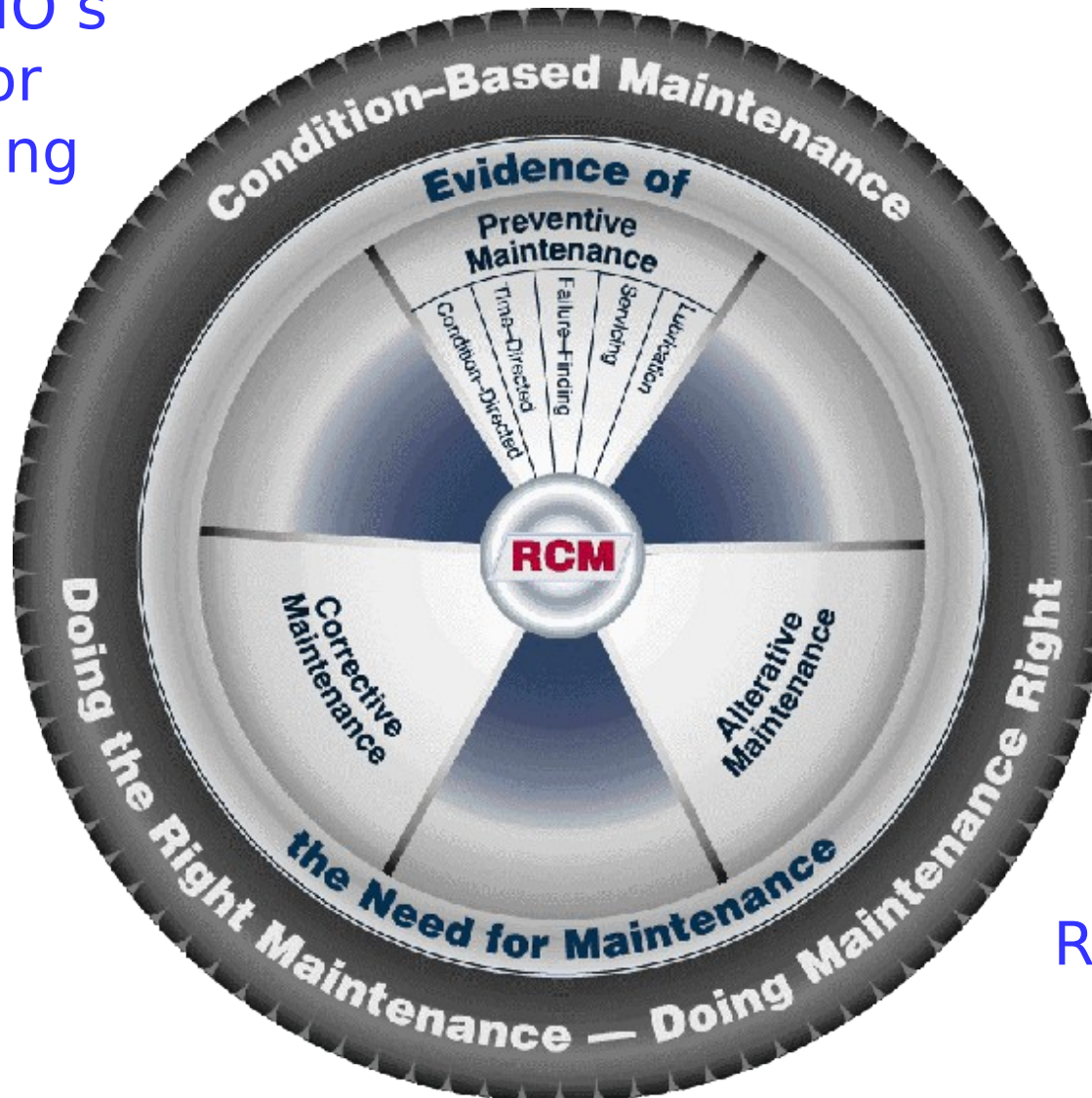
TO

- Condition-Based Maintenance (CBM) based on evidence of need
- Integrated CMP (ICMP) assessment tasks
- Small, frequent availabilities
- Dynamic Deployment cycles to support FRP Surge

Navy Surface Ship Maintenance Transition



CBM Is CNO's
Policy for
Maintaining
Ships



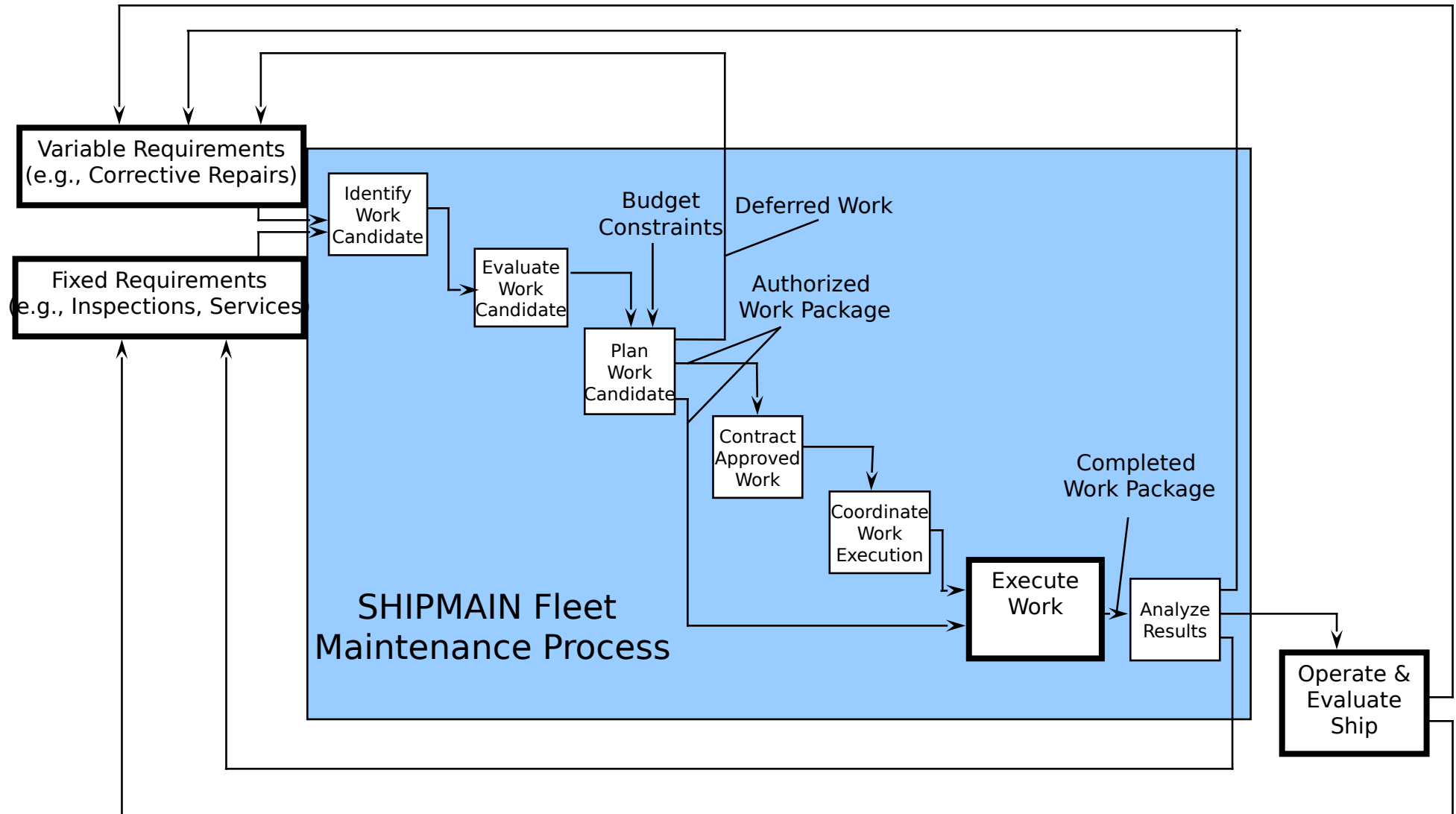
RCM Provides
Rules of
Evidence.

Maintenance Requirements Defined



- **Actions required to maintain or restore satisfactory operational characteristics of our ships**
 - **Preventive Maintenance**
 - Condition-Directed Tasks
 - Time-Directed Tasks
 - Condition Assessment
 - **Corrective Maintenance**
 - Emergent Repairs (fixing broken stuff)
 - Repairs resulting from Condition Assessment
 - **Alterative Maintenance**
 - Modifications required to improve unsatisfactory design performance
- **Deferred Maintenance**
 - Unfunded CSMP items

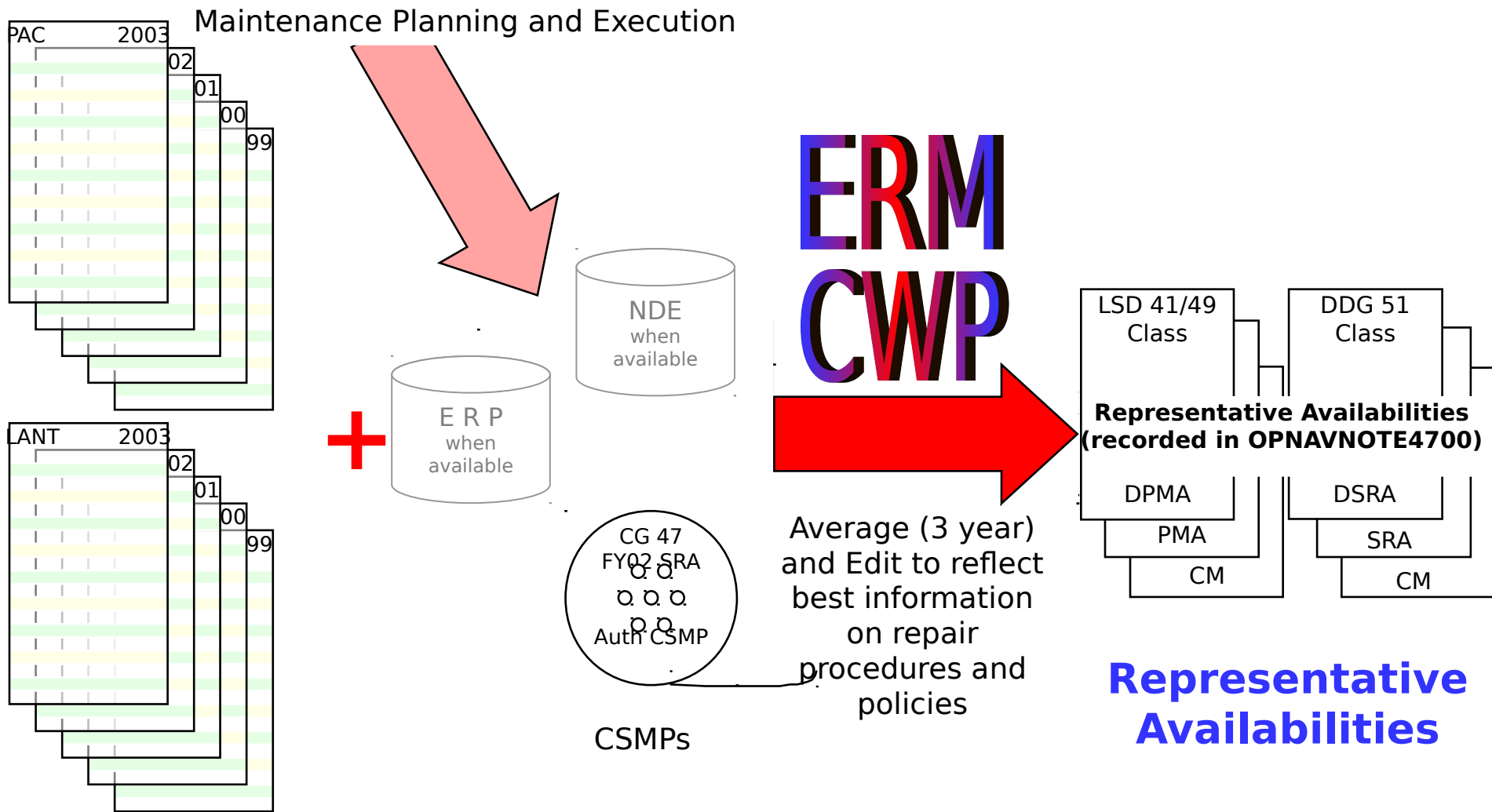
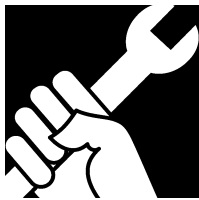
Maintenance Requirements





Maintenance Resource System

Define 100% of the Depot Maintenance Requirements



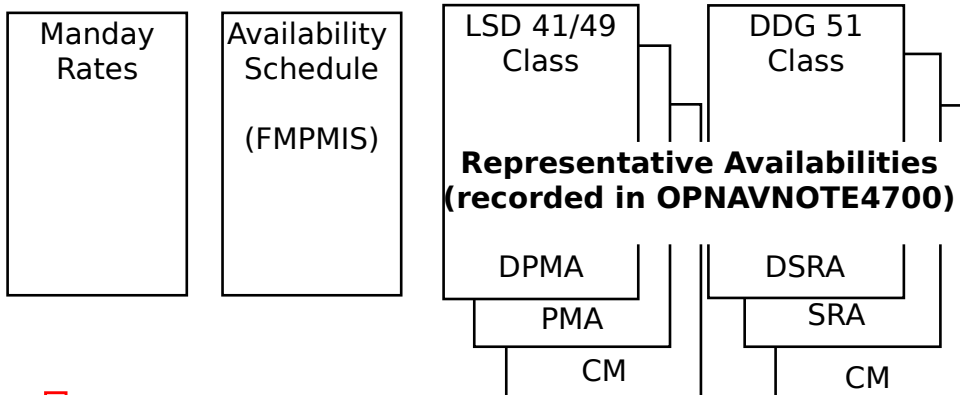
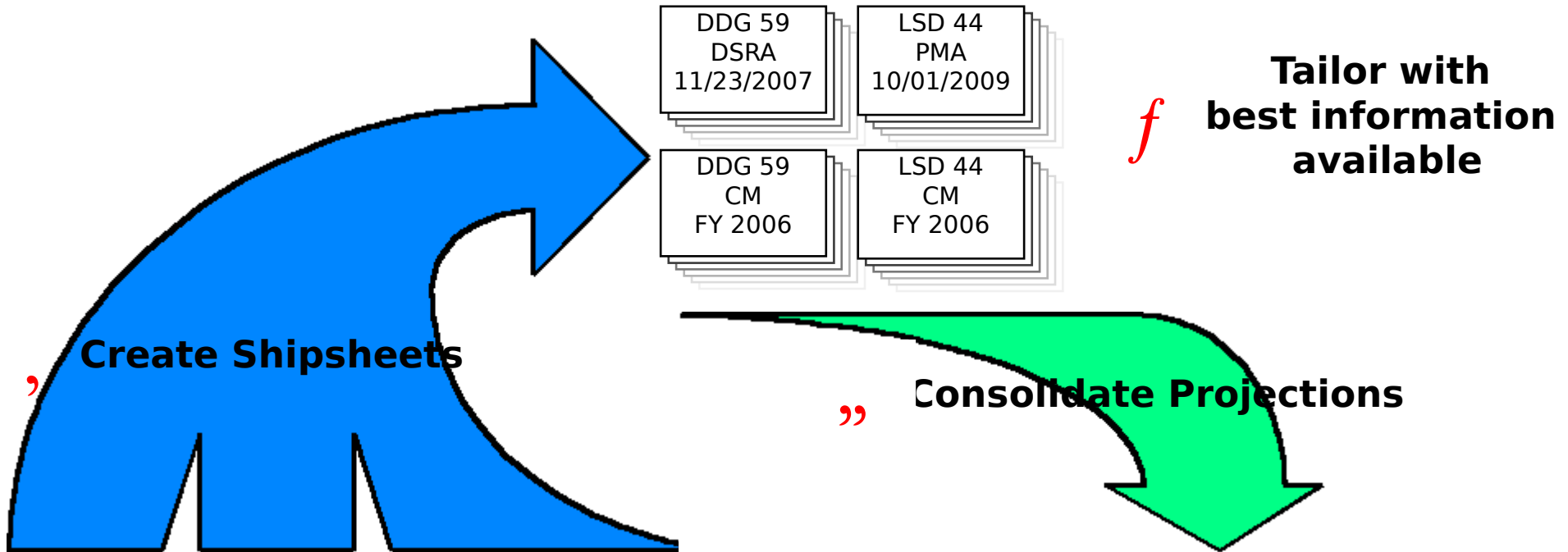
TYCOM Ledgers Depot Repair Records



Maintenance Resource System



Project the Maintenance Requirement



Avail	Fiscal Year					
	06	07	08	09	10	11
DDG 57	—	☐	—	☐	—	☐
DDG 58	—	—	☐	—	—	☐
DDG 59	—	—	☐	—	☐	—
Totals	☐	☐	☐	☐	☐	☐

 Develop Reference Tables



Define risk at the work-item level, as the product of:

- Significance (SEVERITY) of an outcome
[.. Based on safety and system mission importance] *and*
- Likelihood (PROBABILITY) of an outcome
[.. That it will be inoperative if not maintained]

Therefore:

$$\text{RISK} = \text{SEVERITY} \times \text{PROBABILITY}$$

[... The relative risk, associated with each work item in an availability, that the system will fail during the next operating period if the work is not accomplished.]



Maintenance Resource System

Manage Risk in a Constrained Funding Environment



- **Analyze RISK by ship class and availability type:**
 - Ship Work Line Item Numbers (SWLIN) in SHIPSHEET can be sorted by:
 - Severity of failure
 - Probability of failure
 - Cost of work
 - **Descending order of RISK**

- **To determine impact of a Cut, draw a “Cut Line”
*and***

- **Review Mission Impact of items below the “Cut Line.”**
 - Predict additional Mission Area Degradations from CASREPs generated as a result of not performing maintenance below the “Cut Line” by Mission Area and Criticality Code.



Program Guidance

Effect of Reduced Funding



LEYTE GULF, FY 2007, EDSRA

Report Date 09/26/2003

Availability Title: LEYTE GULF, FY 2007, EDSRA OFFICIAL
Repair Activity: TBDEC Ship Name: LEYTE GULF
Ship Class: CG 47 Hull Number: CG 55
Availability Type EDSRA Man Day Rate: \$458.86
Scheduled Begin Date: 04/9/07 Scheduled End Date: 12/7/07

SWLIN	SWLIN Description	Job Type	MCC	Missions Impacted			Sev	Prob	Risk	Man	Material	Cumulative	Total
							Fail			days		Mandays	Cost
1631X	Seachests	R	2	MOB			60	14	8	236	28302	47248	5673503 27351900
52811	Plumbing Drains	R	1	NCO			40	19	8	188	22567	47436	5696070 27460668
12317	Contaminated Oil Tanks	R	1	MOB			40	19	8	487	58453	47923	5754523 27742396
6241X	NonStruc Closures	R	1	MOB			30	26	8	240	28857	48163	5783380 27881477
62111	NonStructural Bulkheads	R	1	NCO			30	26	8	540	64928	48703	5848308 28194409
455XX	IFF Systems	R	3	AAW	ASU	CCC	90	8	7	172	20718	48875	5869026 28294262
44211	Underwater Comms System	R	1	ASW	CCC	FSO	82	8	7	72	8694	48947	5877720 28336165
52621	Deck Drains	R	2	MOB			66	10	7	11	1295	48958	5879015 28342406
671XX	Lockers & Special Stowage	R	2	ALL			45	13	6	28	3330	48986	5882345 28358454
63711	Sheathing/Covering	R	1	MOB			30	19	6	63	7584	49049	5889929 28395007
71311	Gun Ammunition Stowage	R	1	SAF	AAW	ASW	100	5	5	122	14613	49171	5904542 28465439
652XX	Medical Spaces	R	2	MOB			66	7	5	14	1665	49185	5906207 28473463
42411	Fathometer	R	2	MOB			66	7	5	43	5179	49228	5911386 28498426
660XX	Working Spaces	R	1	ALL			40	13	5	136	16278	49364	5927664 28576882
643XX	Enlisted Berth/Mess Spaces	R	1	MOB			30	17	5	83	9989	49447	5937653 28625025
185XX	Auxiliary System Foundations	R	4	UKN			100	4	4	129	15538	49576	5953191 28699915
16821	Deck House WT Doors	R	4	UKN			100	4	4	28	3330	49604	5956521 28715963
136XX	01 Hull Deck (Forecastle and Poopdeck)	R	4	UKN			100	4	4	185	22198	49789	5978719 28822948
63321	Cath Prot Impressed Current	R	2	MOB			78	5	4	75	9064	49864	5987783 28866634
2643X	LO Purifiers	R	2	MOB			40	11	4	510	61228	50374	6049011 29161735
12011	Structural Bulkheads	R	1	MOB			40	11	4	115	13873	50489	6062884 29228601
43611	Alarm Safety & Warn Syst	R	2	MOB			40	10	4	28	3330	50517	6066214 29244649
12315	Lube Oil Tanks	R	1	MOB			40	10	4	385	46245	50902	6112459 29467535
644XX	Sanitary Spaces	R	1	MOB			30	14	4	303	36441	51205	6148900 29643169
661XX	Offices	R	1	ALL			30	13	4	55	6659	51260	6155559 29675265
62511	Fixed portlights windows	R	1	MOB			30	13	4	8	925	51268	6156484 29679723
43211	Dial Telephone Systems	R	1	CCC	NCO		30	13	4	14	1665	51282	6158149 29687747



Managing Risk



Additional CASREPs by Mission Area and Criticality Code

Mission Impact Report

90 % Funding

Ship Class: CG 47

Avail

Type: EDSRA

Mission

SWLINNomenclature

MCC

% Cut

AAW

41411	Tact Data Swbd & Interf Equ	3
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7%

ASW

46511	Bathythermograph	2	3%
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42313	TACAN Beacon	3	4%
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CCC

44191	NAVMACS (Nav Modul Auto	2
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3%

43211	Dial Telephone Systems	1	3%
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MOB

643XX	Enlisted Mess/Berth Spaces	1
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0%

63321	Cath Prot, Impressed Current	2
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Benefits of MRS



- **Restores confidence in maintenance requirement**
 - Surface ship PR03 Program Guidance 95%
- **Provides credible and defensible surface force POM input**
- **MRS User's Group Alliance**
 - NAVSEA04RM (Program Lead)
 - DoN Comptroller
 - OPNAV N42, N43, N75, N76, N80, N81, N82
 - COMFLT N43s
 - TYCOM N43s
 - SUPSHIP Portsmouth (200)



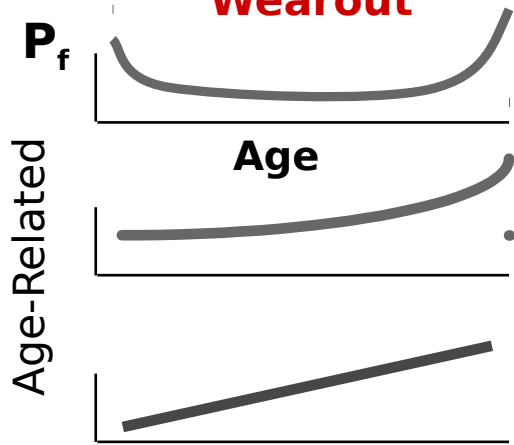
Maintenance Requirements System

Backup Slides

Age-Reliability Curves

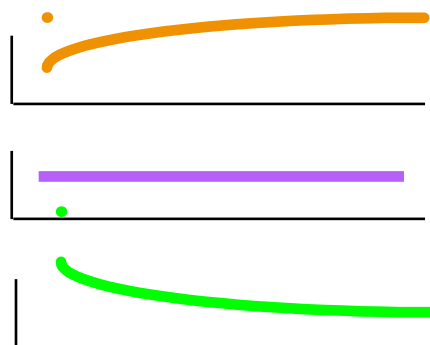


Evidence of Wearout



1973 <u>UAL</u> <u>SUBMEPP</u>	1982 <u>Broberg</u>	MSDP <u>Studies</u>	1993 <u>SSMD</u>	2001
4%	3%	3%	7%	2%
2%	1%	17%		10%
5%	4%	3%		17%

Random



7%	11%	6%		9%
14%	15%	42%	60%	56%
<u>68%</u>	<u>66%</u>	<u>29%</u>	<u>33%</u>	<u>6%</u>

No Evidence of Wearout

89%	71%	92%	77%	93%
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Managing Risk

Severity Factors



Priority	CATEGORY OF FAILURE EFFECT						Severity Factor
1	Personnel Safety						100
2	Ship Mission Capability						
	Mission Area		Mission Effect		Effect on Other Systems		
	Primary	Secondary	Loss	Degradation	Yes	No	
	X		X		X		90
	X		X			X	88
	X			X	X		85
	X			X		X	82
		X	X		X		78
		X	X			X	74
		X		X	X		70
	X		X		X	66	
3	Repair Economics						
	Failure requires depot facilities for correction.						60
	Failure does not require being physically located in a depot, but requires depot personnel or facilities for correction.						55
	Failure does not require depot facilities or personnel for correction, but work can be done most economically during assigned depot availability.						40
4	Other Remaining Failures						30

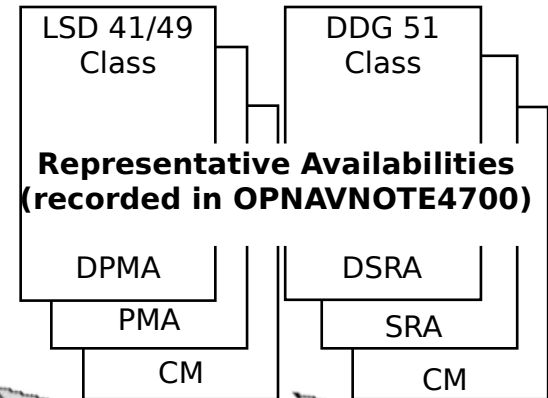
Unfunded Technical Requirements



MRS		YORKTOWN, FY 2003, SRA										Report Date 04/09/2003 OFFICIAL	
Availability Title:		YORKTOWN, FY 2003, SRA										OFFICIAL	
Repair Activity:		SPASC										Ship Name:	
Ship Class:		CG 47										Hull Number:	
Availability Type:		SRA										Man-day Rate:	
Scheduled Begin Date:		06/16/03										Scheduled End Date:	
												YORKTOWN	
												CG 48	
												\$367.52	
												08/15/03	
SWLIN	SWLIN Description	Job Type	MCC	Missions Impacted	Sev	Prob Fail	Risk	Man-days	Material	Cumulative Mandays	Material	Total Cost	
71311	Gun Ammunition Stowage	R	1	SAF AAW ASW ASU	100	11	11	17	1712	8136	818581	3808724	
12314	Potable Water Tanks	R	2	MOB	90	11	10	14	1415	8150	819996	3815284	
655XX	Laundry/Dry Clean Spaces	R	1	MOB	40	26	10	15	1476	8165	821472	3822273	
63711	Sheathing/Covering	R	1	MOB	30	29	9	40	3992	8205	825464	3840966	
46611	LAMPS Mk III Equipment	R	2	ASW	85	11	9	13	1348	8218	826813	3847092	
54211	Av/Gen Purpose Fuel Piping	R	2	MOB	74	11	8	4	397	8222	827210	3848959	
54221	Av/Gen Purpose Pumps	R	2	MOB	74	11	8	5	525	8227	827735	3851322	
52421	Aux Machinery SW Pumps	R	2	MOB	40	20	8	15	1490	8242	829225	3858325	
12011	Structural Bulkheads	R	1	MOB	40	20	8	5	487	8247	829711	3860649	
49261	Helo Deck Lifting (Air Capa	R	1	MOB	30	26	8	14	1391	8261	831102	3867185	
2521X	Auto Prop. Control System	R	3	MOB	85	8	7	12	1164	8273	832266	3872759	
43711	Indic. Order & Meter Syst	R	2	MOB	85	8	7	2	213	8275	832479	3873707	
33111	Lighting Distribution	R	1	MOB	30	23	5	5	536	8280	833018	3876083	
462XX	Passive Sonar	R	3	ASW ASU INT	90	8	7	1	71	8281	833089	3876522	
52621	Deck Drains	R	2	MOB	66	11	7	1	57	8282	833145	3876946	
57141	RAS Booms Raising & Hardware	R	2	MOB	88	8	7	1	142	8283	833287	3877456	
42211	Dial Telephone Systems	R	1	CCC NCO	30	20	6	17	1706	8300	834987	3885403	
643XX	Enlisted Berth/Mess Spaces	R	1	MOB	30	20	6	33	3288	8333	838276	3900820	
42313	TACAN Beacon	R	3	ASW ASU CCC	66	8	5	6	639	8339	838915	3903664	
63121	Exterior Painting	R	1	MOB	30	17	5	102	10279	8441	849194	3951430	
62511	Fixed portlights, windows	R	1	MOB	30	17	5	1	85	8442	849279	3951883	
671XX	Lockers & Special Stowage	R	2	ALL	45	11	5	1	57	8443	849336	3952307	
2421X	Prop. Shaft Clutch & Coupling	R	3	MOB	88	5	4	130	13069	8573	862405	4013154	
483XX	ASW Fire Control System	R	3	ASW	88	5	4	1	57	8574	862461	4013578	
12315	Lube Oil Tanks	R	1	MOB	40	11	4	34	3370	8608	865632	4029444	
33211	Lighting Fixtures	R	1	MOB	30	14	4	5	475	8613	866306	4031756	

(UTR)

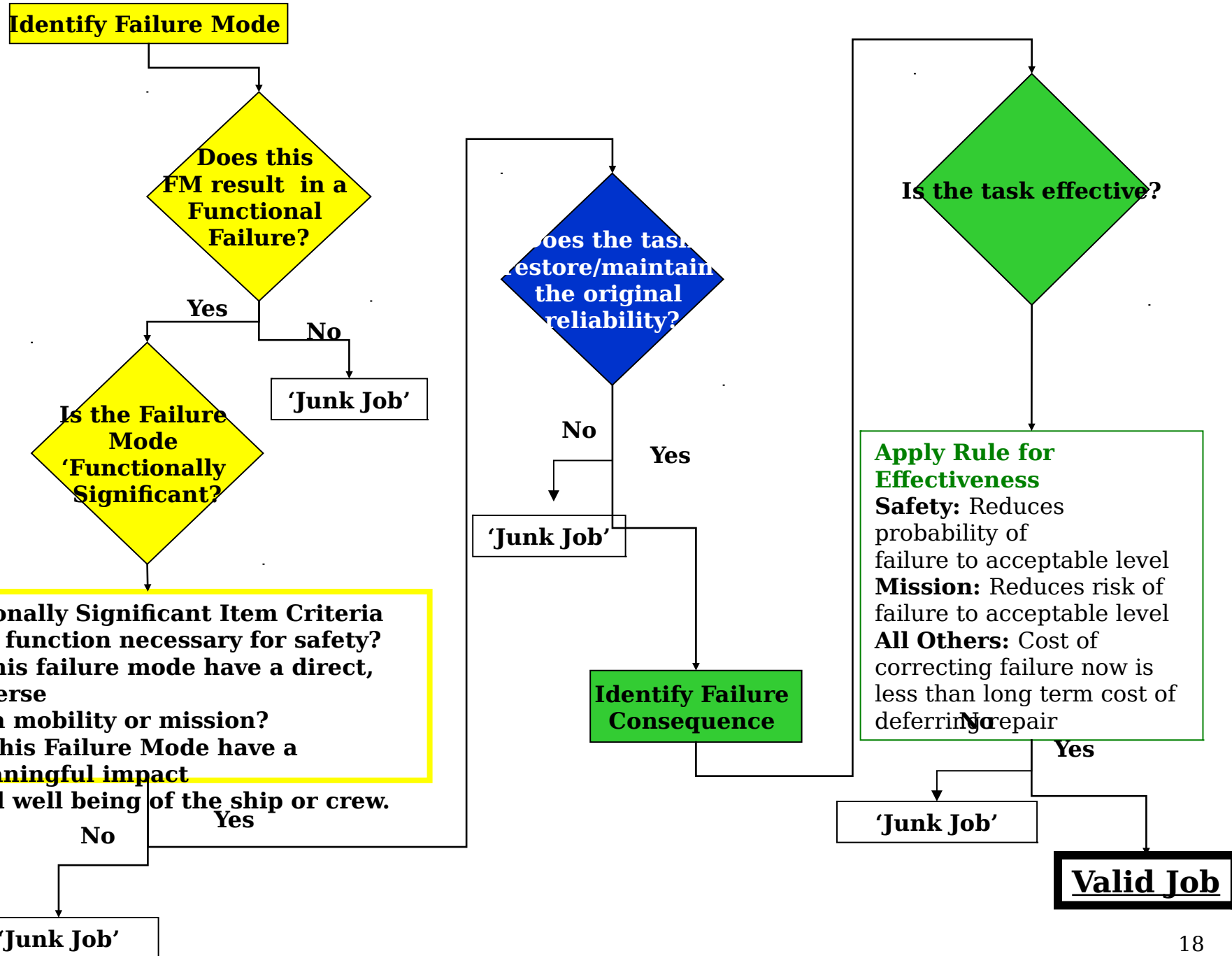
Executed



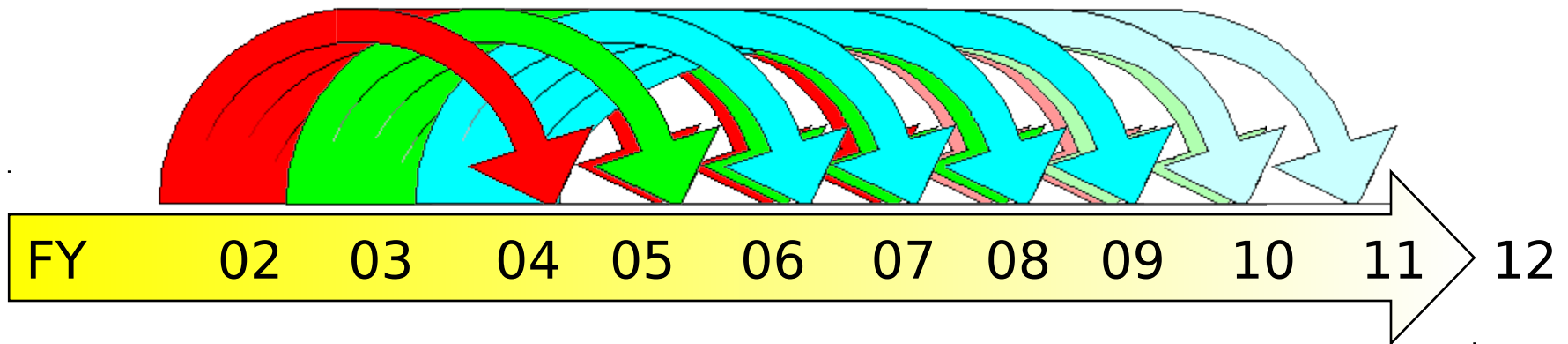
Un-Executed

- Un-funded, executable maintenance requirements that are deferred solely due to funding constraints
- Measured at the end of each Fiscal Year (September 30) for each ship that **was scheduled to** complete a depot availability (as scheduled in FMPMIS) during that Fiscal Year, to develop a class average UTR per hull
- Calculated class average UTR per hull is applied to all ships of the class as CM spread over 4 years
- UTR will be reported as an estimate of man-days and material (dollars)

Road Map for Unfunded Technical Requirements (UTR) MER



Re-Programming UTR



PR05

POM06

PR07

MRS ICMP Linkage



- Improving technical content
 - **Refining ICMP recommended periodicity**
 - **Identification of candidate ICMP tasks**
 - **Identification of “bad” ICMP tasks**
- Method: Linkage with MRS data using SUPSHIP Portsmouth ICMP/MRS cadre
- Next Steps
 - **Fully integrate ICMP tasks into MRS**
 - **Engineered/RCM analysis of ICMP tasks**

